REMARKS

Claims 1, 3-24 and 26-39 are pending in the present application. No new matter has been added. Applicants thank the Examiner for the opportunity to discuss this application in a personal interview. The remarks presented herein are consistent with the outcome of that discussion. In particular, Applicants note that the use of the term "cycle" is clarified herein with regard to the unexpected results.

Rejection under 35 U.S.C. 103

Claims 1, 3-9, 11-24 and 26-39 have been rejected under 35 U.S.C. §103(a) as unpatentable over George et al. ("Surface Chemistry for Atomic Layer Growth") in view of Sandhu et al. (U.S. Patent No. 6,313,035), Leskela et al. (Journal De Physique IV) and Suntola et al. (U.S. Patent Nos. 6,015,590). Claim 10 has been rejected as unpatentable over George et al., in view of Sandhu et al., Leskela et al, Suntola et al., and further in view of Lowrey et al. (U.S. Patent No. 5,891,744).

Specifically, on page 3 of the Office Action, the Examiner alleges that George et al. discloses the limitations of independent Claims 1, 22 and 36, particularly in the atomic layer growth of various metal oxides, and of superlattices. The Examiner concedes that George et al. fails to disclose a film comprising silicon and a transitional metal. However, the Examiner alleges that Sandhu et al. teaches a multi-component oxide comprising a mixture of a metal oxide and silicon dioxide by CVD, and that it would have been obvious to modify George et al. by selecting the metal oxide and silicon dioxide taught by Sandhu et al. "because a mixture of a metal oxide and a silicon oxide to form a useful multi-component oxide layer [can] be used to manufacture a useful semiconductor device." (Office Action, p. 4).

The Examiner further concedes that the combination of George et al. and Sandhu et al. fails to disclose a plurality of consecutive deposition cycles that each deposit only a MSiOx, but alleges that Leskela et al. discloses a ternary metal oxide by ALE. (*Id.*). The Examiner further alleges that it would have been obvious to combine George et al. and Sandhu et al. with Leskela et al. "by using a 1:1 ratio to produce a ternary oxide having a desired [stoichiometry], as taught by Leskela et al." (*Id.*).

Still, the Examiner further concedes that the combination of George et al., Sandhu et al. and Leskela et al. fails to disclose "purging the reactor with an inert gas" after each pulsing, or after each contacting step and after each converting step, as recited in independent Claims 1 and 22. However, the Examiner alleges that Suntola et al. discloses an interval between reactant pulses for evacuation of the entire gas volume in an apparatus during the interval between two successive reactant pulses and an inactive gas, and that it would have been obvious to combine George et al., Sandhu et al. and Leskela et al. with Suntola et al. "to prevent CVD film growth conditions, which are detrimental in an atomic layer epitaxy process."

This rejection is respectfully traversed, and Applicants submit the following.

A Reason to Combine the References Has Not Been Established

Applicants maintain that the Examiner has failed to provide a reason to combine the numerous references. In *KSR International Co. v. Teleflex Inc.*, 550 U.S. _____ (2007), the Court has made it clear that some reason to combine or modify the various elements must be clearly stated and explained in order to establish a *prima facie* case of obviousness. Specifically, the Court noted that "rejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be ***some articulated reasoning with some rational underpinning*** to support the legal conclusion of obviousness." (*KSR*, 550 U.S. at ___, 82 USPQ2d at 1396 quoting *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) (emphasis added)).

Applicants submit that instead of providing articulated reasons to combine all the references, the Examiner only provides general statements that it would have been "useful" or "desired" for combining the various teachings of the art. For example, the Examiner alleges on page 4 of the Office Action that it would have been obvious to combine George et al. and Sandhu et al. to "manufacture a ***useful*** semiconductor device," and that it would have been obvious to combine George et al., Sandhu et al. and Leskela et al. to "produce a ternary oxide having a ***desired*** [stoichiometry]" (emphasis added). However, Applicants submit that vague allegations of ***usefulness*** or ***desirability*** of a particular combination, without further reasons as to why such combinations would be useful or desired, are insufficient reasons to support a legal conclusion of

obviousness because they are merely generalizations lacking any "articulated reasoning with some rational underpinning," as required by the Court in KSR.

In response to Applicants' previous arguments that the Examiner has not provided a reason to combine the references, the Examiner states on page 8 of the pending Office Action that while Sandhu et al. discloses a "***useful*** material which can be produced by vapor deposition techniques," George et al. "teaches a process which is ***capable of producing the useful material*** taught by Sandhu et al." and that it would have thus been obvious to modify George et al. to produce the useful metal silicon oxide material taught by Sandhu et al. (emphasis added). Applicants submit that the mere ***capability*** of the teachings from one references to be used to produce a material disclosed in another reference is an improper standard of obviousness, and does not reflect any "articulated reasoning with some rational underpinning" for combining the art. For example, a less efficient or more expensive method may be ***capable*** of producing the "useful material" by Sandhu et al., but without a reason to do so, a skilled artisan would not be led to replace the CVD methods of Sandhu et al. with a less efficient or more expensive method that is nevertheless ***capable*** of producing the "useful material" of Sandhu et al.

Indeed, Applicants submit that the skilled artisan would appreciate that because of the high level of process control involved, ALD methods are more time consuming, more expensive and less efficient than CVD methods. Without a well articulated reason for why the skilled artisan would desire such a high level of control as to forgo the efficiency and throughput and accept the increased cost, the skilled artisan simply would not have replaced the CVD methods of Sandhu et al. with the ALD methods of George et al. to form the "useful materials" of Sandhu et al., as the Examiner alleges. Thus, the Examiner's allegation that the methods of George et al. are ***capable*** of producing the "useful material" of Sandhu et al. is simply not a sufficient ground for obviousness because it provides no rational basis as to why the skilled artisan would choose to form the particular CVD films disclosed in Sandhu et al. with the ALD methods of George et al. instead.

Thus, Applicants submit that the Examiner's allegations of the general ***usefulness*** or ***desirability*** of a particular combination, and the mere ***capability*** of a particular teaching, are improper and insufficient reasons to modify the teachings of George et al. with Sandhu et al., and to further modify the teachings of George et al. and Sandhu et al. with Leskela et al. and Suntola

et al. Indeed, the Court in KSR noted that "inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." (*KSR*, page 15). However, "[a] patent composed of several elements is ***not proved obvious merely by demonstrating that each element was, independently, known in the prior art.***" (*KSR*, Syllabus, page 4 and page 14 (emphasis added)). Applicants submit that the Examiner does exactly what is prohibited by the Court in KSR. Specifically, the Examiner tries to allege obviousness by merely demonstrating that at least four of the claimed elements were ***independently known*** in the various different teachings of George et al., Sandhu et al., Leskela et al. and Suntola et al. The Examiner further alleges that the combination of all four different references would have been obvious, without articulating any reason with rational underpinning to combine any two or three, no less all, of the references.

Specifically, the Examiner has failed to provide any reason for why the skilled artisan would have been led to modify the ***ALD*** teachings of ***binary oxides*** in George et al. with the ***CVD*** teachings of ***multi-component oxides*** in Sandhu et al. for forming a "useful semiconductor device," when both George et al. and Sandhu et al. independently provide sufficient methods of forming a "useful semiconductor device." The Examiner has pointed to no deficiencies in Sandhu et al. that would be made up for by using an ALD process or any other reason to deposit the materials of Sandhu et al. by ALD. Moreover, the Examiner has provided no explanation of what kind of hypothetical "semiconductor device" would allegedly result from the combination of George et al. and Sandhu et al. or how such a device would benefit by the deposition of the material of Sandhu et al. by ALD. The Examiner merely assumes that the costs of modification in combining the methods of George et al. and Sandhu et al. would be worthwhile, with no explanation as to why the skilled artisan would even make such a combination in the first place. Applicants submit that these broad generalizations cannot sustain a *prima facie* case for obviousness.

The Examiner also articulates no reason to ***further*** combine the disparate teachings of George et al. and Sandhu et al. with the ALE teachings of Leskela et al., and no reason for how combining these three teachings would provide "a ternary oxide having a desired stoichiometry." Despite the allegation that the combination of the teachings of George et al. and Sandhu et al. would provide a "useful semiconductor device," the Examiner does not provide any reason that

modifying the combination of George et al. and Sandhu et al. with the teachings of Leskela et al. would further enhance the hypothetical "useful semiconductor device" and thus has not provided the necessary reason that the skilled artisan would make the asserted combination. The Examiner has simply ***not articulated any reason*** to modify the combination of George et al. and Sandhu et al. with Leskela et al.

Applicants note that the Examiner has stated in the Interview Summary of February 22, 2008, that "the Leskela reference is merely provided to show that ternary compounds via ALD [are] known in the art and George's superlattice growth via ALD is the primary art." However, as recognized in the Office Action neither George nor Sandhu et al. teaches a plurality of deposition cycles that deposit only a $MSiO_x$ and Applicants submit that even if Leskela et al. discloses that ternary compounds via ALD were known, although rare, Leskela et al. still does not provide any reason for the skilled artisan to combine its teachings with George et al. and Sandhu et al. to arrive at the claimed invention. Indeed, Applicants note that Leskela et al. discusses at length the formation of ***binary oxides*** and states that "[t]he growth of ternary oxides by ALE is a challenge." (Leskela et al. C5-946). Accordingly, Leskela et al. actually ***teaches away*** from combination of George et al. and Sandhu et al., and certainly provides no reason for the skilled artisan to combine its teachings with the ALD methods of forming binary oxides in George et al. and the CVD methods of forming multi-component oxides in Sandhu et al.

By not articulating well supported reasons to combine the cited references to arrive at the claimed invention, it appears that the Examiner uses hindsight reasoning instead to allege that a particular combination of art is generally 'useful' or 'desirable'. It is error to reconstruct the patentee's claimed invention from the prior art by using the patentee's claim as a "blueprint." *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 227 USPQ 543 (Fed. Cir. 1985). There appears to be no other rationale for the Examiner's combination of various references, but that the Examiner starts with the patentee's claim as a 'blueprint' and then identifies four disparate references for disclosing at least four different claim limitations. Applicants submit that the Examiner is surely aware that such hindsight reasoning is impermissible. *See* M.P.E.P. 2141.

Since the Examiner has not provided any of the required reasoning to sustain a legal conclusion of obviousness, Applicants respectfully request withdrawal of the rejection to Claims 1, 22 and 36, and Claims 3-9, 11-21, 23-24 and 26-35 and 36-39, which depend therefrom.

Unexpected Results

Although Applicants disagree that the Examiner has established a *prima facie* case of obviousness, Applicants maintain that even if a *prima facie* case of obviousness has been established, the unexpected results of the claimed methods necessitate a finding of nonobviousness. Unexpected results can rebut a *prima facie* case of obviousness because that which would have been surprising to a person of ordinary skill in a particular art would not have been obvious. *In re Soni*, 54 F.3d 746 (Fed. Cir. 1995).

Applicants submitted in an Amendment dated October 31, 2007 experimental results demonstrating that the inventors of the present application have discovered unexpectedly that the growth rate of metal silicon oxides is faster than the growth rates of the either metal oxide or silicon oxide from which the metal silicon oxide is formed. (*See* pages 3 and 9 of the Application, and table on page 8 of the Applicants' Amendment dated October 31, 2007). The Examiner previously found the Applicants' argument of non-obviousness due to unexpected results unpersuasive. (See Office Action mailed December 28, 2006, pages 10-11). The Examiner believed that the higher growth rate of a multicomponent oxide is "expected" over the growth rate of a single-component oxide because a cycle of a multicomponent oxide deposition includes twice as many deposition steps, or in other words that a silicon oxide and a metal oxide are formed in "one cycle" for the multicomponent oxide, whereas only silicon oxide or metal oxide is formed in one cycle for a single-component oxide.

Applicants submitted in response that this was an incorrect reading of the data presented in the Application, and that the Application is clear that in comparing the growth rate of a multicomponent oxide to that of individual metal oxide or silicon oxide, a cycle is expressed in terms of a single cycle of metal oxide, or a single cycle of silicon oxide. (*See* paragraph [0048] and Example 2 of the Application). For example, the Application states that a threefold increase in growth rate for $SiYO_2$ and $SiLaO_2$ is achieved with a "cycle ratio of 1:1," or when a cycle of metal oxide is alternated with a cycle of silicon oxide. Evaluating the growth rates of a multicomponent oxide, silicon oxide and metal oxide in a way that fails to standardize the units of comparison, would be uninformative and unreasonable, and is not the comparison that is being made by Applicants in the above-identified sections of the Application.

The Examiner continues to disagree with the Applicants and specifically argues on page 9 of the pending Office Action:

> "The specification does not provide the interpretation of cycle as alleged by applicant. A cycle comprising both a metal and a silicon oxide deposition (the Examiner's position) is clearly evidenced by the language of claim 1 which defines a cycle as contacting a silicon compound, metal compound, and converting to metal oxide by contacting with a oxygen source. Therefore, the examiners interpretation of "cycle" is accurate and the results are not unexpected, as discussed in the prior action."

First, Applicants do not understand the Examiner's allegation that the specification "does not provide the interpretation of cycle as alleged by applicant." Specifically, paragraphs [0040] and [0041] of the Application clearly disclose what is meant by cycles of metal oxides or of silicon dioxide, and further discloses that "by preparing the mixed oxide of these metal oxides mentioned above with silicon dioxide using the ***cycle ratio*** of 1:1 a growth rate of more than threefold, 0,7 Å/cycle, is achieved." Moreover, the table of Example 2 also presents a "***cycle ratio*** (M:S)" in a column. Applicants submit that if this part of the specification did not describe a cycle as a single cycle of silicon oxide or of metal oxide, then a "cycle ratio (M:S)" as described in Example 2 would have no meaning. Indeed, paragraph [0051] in the Application explicitly refers to the cycle of M as the "number of the cycles of the metal source material" and S as the "number of the cycles of the silicon source material." Thus, the above-identified sections of the specification make it clear that in the context of comparing growth rates a "cycle" is a cycle of a metal oxide or of a silicon dioxide.

Second, Applicants do not dispute the Examiner's position that ***with respect to Claim 1*** a "cycle" is a cycle of a metal silicon oxide. This is "clearly evidenced by the language of claim 1" as the Examiner alleges. However, Applicants note that the term "cycle" is used differently in Claim 1 than in the above-identified sections of the specification. There is no prohibition against such different uses and no inconsistencies arise from it. Applicants submit that the term "cycle" like "process" is not a set property; rather it is a term whose meaning need not be restricted so long as it is consistently used within its context. Claim 1 uses the term "cycle" for the purpose of clearly setting forth the elements of the claimed invention, and is consistently used throughout the dependent claims as such. In contrast, "cycle" is used differently in the specification for the ***different purpose of comparing the relative growth rates*** of metal silicon oxides, silicon oxides

and metal oxides. However, the term "cycle" is used consistently in the specification and in the experimental results presented by Applicants ***for the purpose of comparing the relative growth rates*** of different oxides and metal silicon oxides. Accordingly, Applicants do not dispute the Examiner's interpretation of "cycle" with respect to Claim 1, but submit that it has no bearing on the interpretation of the unexpected results that are presented.

Thus, Applicants do dispute the Examiner's interpretation of the experimental results presented, and the Examiner's assumption that the different use of the term "cycle" makes the results "not unexpected." Again, Applicants submit that it is not required that the term "cycle" have the same meaning in Claim 1 and in Applicants' presentation of unexpected results. It is not proper for the Examiner to allege that because "the Examiner's interpretation of "cycle" is accurate" ***with respect to Claim 1***, the unexpected results described in the specification and subsequently presented by Applicants are meaningless or false. Applicants maintain that there is no reason, and indeed it would be unreasonable, to use the term "cycle" inconsistently within the above-identified sections of the specification ***for the purpose of comparing the relative growth rates*** of different oxides. Applicants submit that the ***only reasonable way to compare*** the relative growth rate of a multi-component oxide to that of a single-component oxide is to keep the denominator of the units of growth rate (Å/cycle) consistent. Applicants' data was derived using this approach and there is simply no reason for the Examiner to assume that Applicants data compares the growth rates of different oxides unreasonably, by inconsistently defining a "cycle" as a cycle of silicon oxide or metal oxide in one instance, and then a cycle of metal silicon oxide in a second instance. Applicants' data was derived using the term growth rate consistently and thus accurately presents the unexpected results that were obtained.

Further, inconsistent use of the term "cycle" would not provide a proper or meaningful comparison of the ***relative*** growth rates of a metal silicon oxide, silicon oxide, and metal oxide. Instead, the result of comparing the growth rates of a single-component oxide and a multi-component oxide with such an inconsistent definition of "cycle" would be that the value of the growth rate in Angstroms ***per cycle*** of the multi-component oxide would automatically be a higher number, but not actually reflective of a higher ***relative growth rate***. When the Examiner argues that the higher growth rate of a multicomponent oxide is "expected" over the growth rate of a single-component oxide, because a cycle of a multicomponent oxide deposition allegedly

includes twice as many deposition steps as a cycle of a silicon oxide or a metal oxide, the Examiner presumes exactly such an improper comparison that employs inconsistent use of "cycle," as a cycle of silicon oxide or metal oxide in one instance, and cycle of a metal silicon oxide in a second instance. Applicants submit that there is no reason for the Examiner to assume that the inventors employed such inaccurate characterizations, when it is clear from the specification that when comparing growth rates "cycle" was used consistently in order to render meaningful comparisons.

Thus, Applicants request that in regard to the unexpected results that have been presented, the Examiner recognize that the term "cycle" was consistently used to mean a cycle of silicon oxide or of metal oxide. Applicants submit that the plain language of the above-identified sections in the Application and the Amendment dated October 31, 2007 provides clear and consistent descriptions of the unexpected results of the claimed invention and that the clear showing of unexpected results overcomes any *prima facie* case of obviousness. Accordingly, Applicants respectfully request withdrawal of that the rejection to independent Claims 1, 22 and 36, and Claims 3-9, 11-21, 23-24 and 26-35 and 36-39, which depend therefrom.

No Disclaimers or Disavowals

Although the present communication may include characterizations of claim scope or referenced art, the Applicants are not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. The Applicants reserve the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that the Applicants have made any disclaimers or disavowals of any subject matter supported by the present application.

Co-Pending Applications of Assignee

Applicant wishes to draw the Examiner's attention to the following co-pending applications of the present application's assignee.

Serial Number	Title	Filed
10/148525	METHOD OF GROWING OXIDE FILMS	08/27/02
11/615827	METHOD OF GROWING OXIDE FILMS	12/22/06

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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